

AMENDMENTS TO THE DRAWINGS

The attached sheet(s) of drawings includes changes to .

In Fig. 1, the legend "PRIOR ART" is added.

In Fig. 4B, reference number 60 is added to denote the rotor shaft of motor
30a.

In Fig. 4C, reference number 81 is added to denote a cover.

Attachment: Replacement sheet
 Annotated sheet showing changes

REMARKS

Applicants note that claims 32-38 are withdrawn as directed to a non-elected invention, and that claims 13 and 14 were found to define patentable subject matter.

The foregoing amendments in the specification and drawings address the Section 112, second paragraph, rejections. Typographical errors in spelling "view," "an" and "radiation" are corrected on pages 10, 21 and 22. On page 14, line 29, the text is edited to make it clear that "8 axis" refers to the "axes of articulation" referenced in line 23. These axes are specified in the rest of the sentence appearing on page 14, lines 29-30.

Fig. 1 does show a prior art system, and it is now so labeled, as suggested by the Examiner.

Fig. 4B now has reference number 60 on the rotor shaft of motor 30a. (Rotor shafts for motors 30b and 30c are denoted 60'.)

Fig. 4C is amended to include reference number 81 (page 19, line 3) for a "man-hole like" cover under the replaceable gripping pad 77b, as described on page 18, line 15 to page 19, line 7.

The Examiner also objects to a failure to show reference number "546" in the drawings. Applicants have scanned the specification and do not find the reference number "546" in the text. Possibly "54b" is meant. It was used once at page 21, line 1, with reference to the "angle iron" base 54 shown in Fig. 14. "54a" is used in Fig. 3 with reference to the base plate of base 54 of the Fig. 2-6 embodiment. Therefore, as it is clear from Figs 14A-14E the surfaces of the angle iron base 54 that engage the various objects 100, applicants have deleted the reference numbers "54a and 54b" in the specification at page 21, line 1.

The Section 112, second paragraph, rejections and the objections to the drawings are therefore believed to be overcome.

In reviewing the specification in connection with this response, applicants have noted various other minor typographical and grammatical errors, and other minor errors. They are noted below and corrected. Because of their number, applicant is submitting herewith a substitute specification that makes these corrections pursuant to 37 CFR 1.125. These changes do not introduce new subject matter.

At page 9, line 3, "On" is changed to "In."

At page 13, line 6, "embodiment" is changed to "embodiments."

At page 13, line 28, and also on pages 14, line 2, page 24, line 26, page 25, line 31, and page 26, lines 4, 11, and 16, "CAN-bus" or "CAN bus" is changed to "CANbus."

At page 14, line 25, a comma (",") is inserted after "46."

At page 15, line 27, "32d" is changed to "32a" to be consistent with the joint 32a shown in Fig. 4B and the rest of the specification.

At page 16, lines 1 and 5, "worm gear" is changed to "worm" to reflect that the part referred to and shown is in itself a worm.

At page 16, line 2, "rotor" is changed to "rotors."

At page 16, line 30, "bar" is changed to "bare."

At page 19, line 17, "shape" is changed to "shapes."

At page 21, line 2, "Fig." is changed to "Figs."

At page 21, line 26, "successor" is changed to "succession."

At page 22, line 16, "photo transistors" is changed to "photo-transistor" and "configures" is changed to "configured."

At page 22, line 20, "of" is changed to "or."

At page 23, line 15, “palm surfaces 44, 44” is changed to “bases 54, 54” to be consistent with Fig. 19 showing two robotic hands of the present invention secured to other another back-to-back and sandwiching a mobile power source 112.

At page 24, line 8, the word “all” is moved to make it grammatically clearer that multiple motors are networked and Network Operating Device (NOD) 38 “orchestrates the activities” of this network.

At page 24, line 15, “particles” is changed to “waves.” While high-energy gamma rays, as with all protons, exhibit matter/energy equivalence, “gamma waves” is used as being more conventional than “gamma particles.”

At page 25, line 6, delete “74.” The deletion makes it clear that the embodiment described here is not the illustrated circuit board 74 embodiment.

At page 25, line 21, “refer” is changed to “refers.

Applicants note that on page 21, line 4, the specification states that the finger 46 has three links. This reflects a link count that includes the base. Certain of those skilled in the art may also characterize the links shown and described as a two-link structure.

Turning now to the claims, dependent claim 2 is amended to change “said hand” to “the robotic device,” the term used in claim 1 instead of “hand.”

A typographical error is corrected in each of claims 4 and 26.

Claims 17 and 19 are amended to specify that the at least one finger of claim 1 is at least two fingers. The Section 112 rejections of claims 12-19 are therefore overcome.

Claim 21 is amended to more clearly follow the language of claim 10 from which it depends in defining a sensor that provides vision information to the claimed intelligent, practical robotic device.

The dependency of claim 31 is corrected to claim 15, not claim 5, to provide a clear antecedent basis for “said angled links.”

Applicants respectfully traverse the rejection of claims 1-12 and 15-31 either under 31 USC 102 as anticipated by U.S. Patent No. 2,567,066 to Goldman (claims 1-10, 15, 16, 19, 20, 30, 31) or under 35 USC 103(a) as obvious over Goldman '066 in view of Priolo et al. U.S. Patent No. 5,346,351 (claims 11, 12, 25-27), Ulrich U.S. Patent No. 5,501,498 in view of Goldman (claims 1-10, 16-20, and 24) or Ulrich '498 in view of Goldman '066 when further combined with Maydan U.S. Patent No. 5,280,983 (claims 21-23, 28 and 29).

Goldman '066 is a 1948 patent describing an artificial human limb, e.g. a hand or a portion of a leg and a foot. The Goldman hand, e.g. as shown in Fig. 3, has finger portions each pivoted by a small solenoid mounted within the artificial hand located near an associated joint and acting through a lever arm. Wires 25 supply power to the solenoids from a battery 27. The fingers can grip under the control of a spring-loaded switch 30 (Fig. 4) "carried in the mouth of the wearer ... so that a difference in biting pressure may be used to control the different outer and inner joints of the hand ..." (Col. 1, lines 17-22). Further, "the control unit consists of contacts 32 and 33" closed by member 34" which is "manually" (orally) operated by opening and closing the jaw (Goldman claim 6).

The Goldman artificial hand does not teach or suggest the present claimed invention. First, applicants' robotic device as claimed is "practical," as that term is defined in the specification at least on pages 3-6. It does note merely "grip and grasp" as with the Goldman hand; it is dexterous.

Second, applicants' robotic device is defined as "self-contained." Goldman's artificial hand requires a control switch to be held in the user's mouth, not in the robotic hand itself.

Applicants also specify that the claimed invention includes "an electronic controller located proximate each of said actuators ..." Goldman has no control element "proximate each" of its actuators -- the solenoids 22. Also, while Goldman's switch is an electrical switch, it is manually actuated, and merely a switch; it is clearly not an "electronic controller" as described and claimed in the present application.

Further, there is no wiring in Goldman to interconnect plural controllers, as claimed, no “distributed control network,” as claimed, nor any “network operating controller” that is interactively connected to all said actuator controllers.” (Emphasis supplied.) (In Goldman there is only one control device, the switch 30.) Still further, Goldman does not teach or suggest a “controller coordinating the operation of said actuators through said distributed network of said actuator controllers.”

Still further, Goldman has no teaching of many features defined by the dependent claims. As some examples from the first few claims, Goldman does not teach: the use of signal wires and power wires (claim 4); electrical connection through a joint (claim 6); distributed controllers proximate the joint functioning as a network controller (claim 7); many of the sensor types defined by claim 10; or a brushless motor actuator (claim 11).

The Ulrich, Priolo, and Maydan references do not overcome these deficiencies of the Goldman reference, or, in any combination, render the cited claims obvious.

Priolo is cited only as teaching a worm gear drive, and Maydan is cited only for the use of optical sensors on a gripper. These features, as well as the other teachings of these references, do not supply the deficiencies noted above in the Goldman reference.

Moreover, with respect to claims 25-27, there is no disclosure that the mounting of the Priolo worm gear supports the rotor shaft, or that the motor used in Priolo is in any way non-conventional, e.g. does not have internal motor bearings. Claims 25-27 specify that the motor shaft is supported in a housing external to the motor. As described at page 15, lines 23-32 of the specification, the claimed external-to-the-motor support of the motor shaft is important in reducing friction, providing an enhanced performance, and providing a “drop-in” assembly. These claimed features of claims 25-27 are not taught or suggested by Goldman, Priolo, or the other art of record, alone or in combination.

The Ulrich ‘498 reference discloses a robotic hand that has three “fingers,” each with plural articulated joints. One finger is fixed on a base, and two other fingers are

rotatable about the base and the fixed finger. This hand is discussed in the specification at least at page 4, line 1-4; it is what applicants term an "academic", not "practical," hand.

The Ulrich '498 hand has a controller 250 remote from the joints of the hand, and, indeed, from the hand itself, which renders this hand commercially impractical. A bundle 240 of cables for sensors and power run from the controller 250 to a connector 230 on the hand. There is no teaching or suggestion in Ulrich '498 of using "an electronic controller located proximate each of said actuators," a distributed network of those controllers, or a network operating controller interactively connected with them. Rather, Ulrich '498 focuses on a mechanical power transfer along each finger using clutch mechanisms 100. These clutch mechanisms are serially arrayed along a finger between a motor 175 and an outermost link. As Ulrich states at col. 8, lines 54-57, "... each finger 30, 40, 45 ... is comprised of means which transfer power from a single actuator to a first joint 72 and to a second joint 74 ..." And significantly, rather than using electronic controllers at each joint, Ulrich teaches that "...[t]he breakaway clutch mechanism 100 ... provides fingers 30, 40, 45 with the ability to 'wrap' around an object to be grasped in an autonomous manner, that is, without a separate sequence of directions from the controller 250." (Emphasis supplied.)

Ulrich '498 therefore teaches directly away from any electronic controller to develop a grasping motion, let alone a network of controllers distributed throughout the hand. Moreover, it is difficult to imagine how the "cascaded" clutches of Ulrich can somehow be combined with the Goldman '066 solenoids and mouth-held switch control. In summary, applicants do not find the teaching or suggestion in the cited art, whether taken alone or in any combination, of many of the claimed features.

Applicants are submitting herewith a Supplemental Information Disclosure Statement citing additional prior art. Applicants understand none of this art, whether taken singly or in combination, to teach or suggest a plurality of electronic controllers, each located proximate an actuator at an associated joint of a robotic device, that are networked, nor the provision of a network operating controller, as required by all of the pending claims.

In view of the foregoing amendment, remarks and submissions, applicants urge that the claims now pending define patentable subject matter over the art of record, and that this application is in condition for allowance.

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Respectfully submitted,

By Peter J. Manus
Peter J. Manus

Registration No.: 26,766
EDWARDS ANGELL PALMER & DODGE
LLP
P.O. Box 55874
Boston, Massachusetts 02205
(617) 439-4444
Attorneys/Agents For Applicant

Attachments

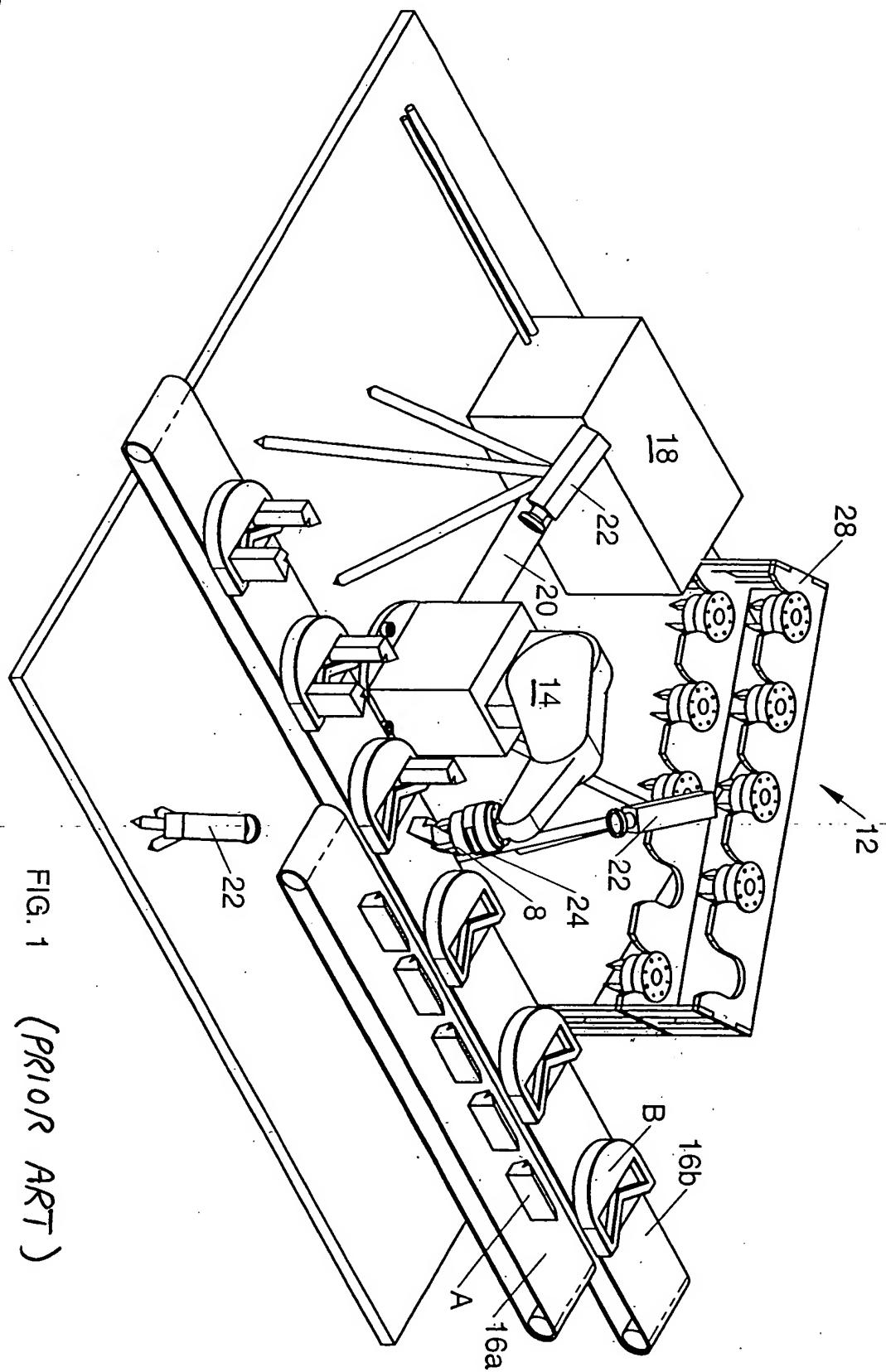
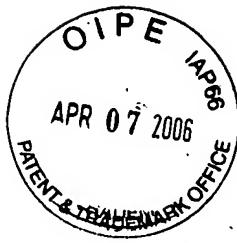


FIG. 1 (PRIOR ART)

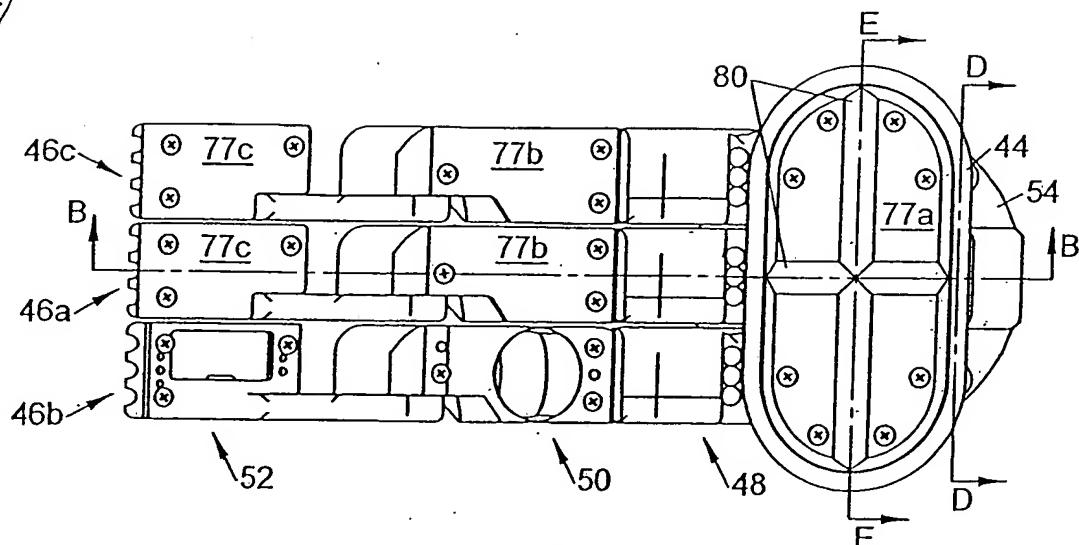


FIG. 4A

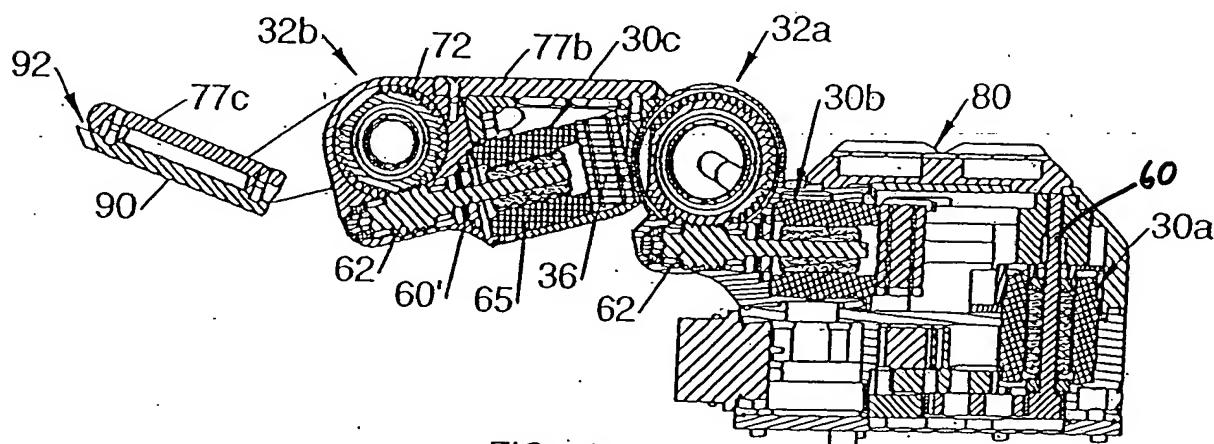


FIG. 4B

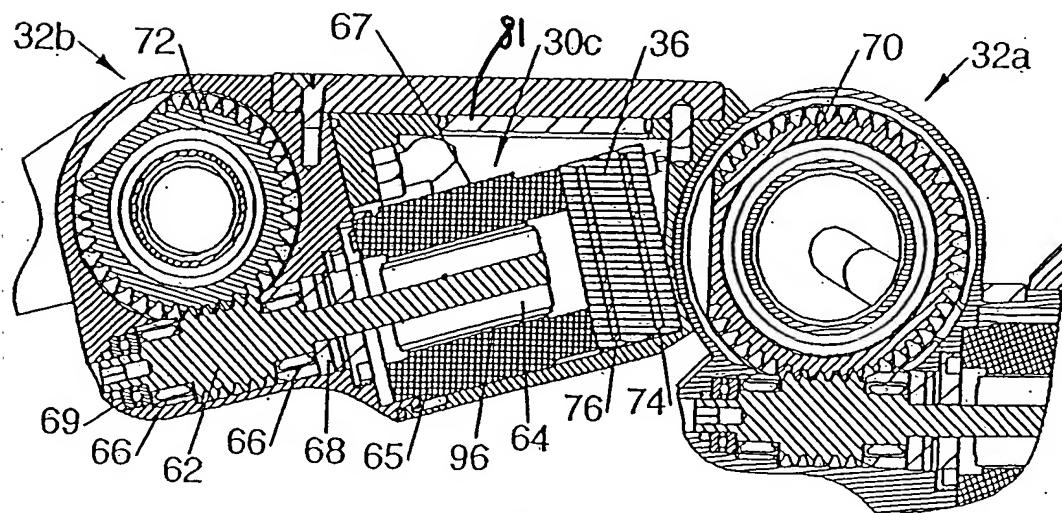


FIG. 4C